K150 Radiation Effects Facility

at the Texas A&M University Cyclotron Institute

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http://cyclotron.tamu.edu/ref/

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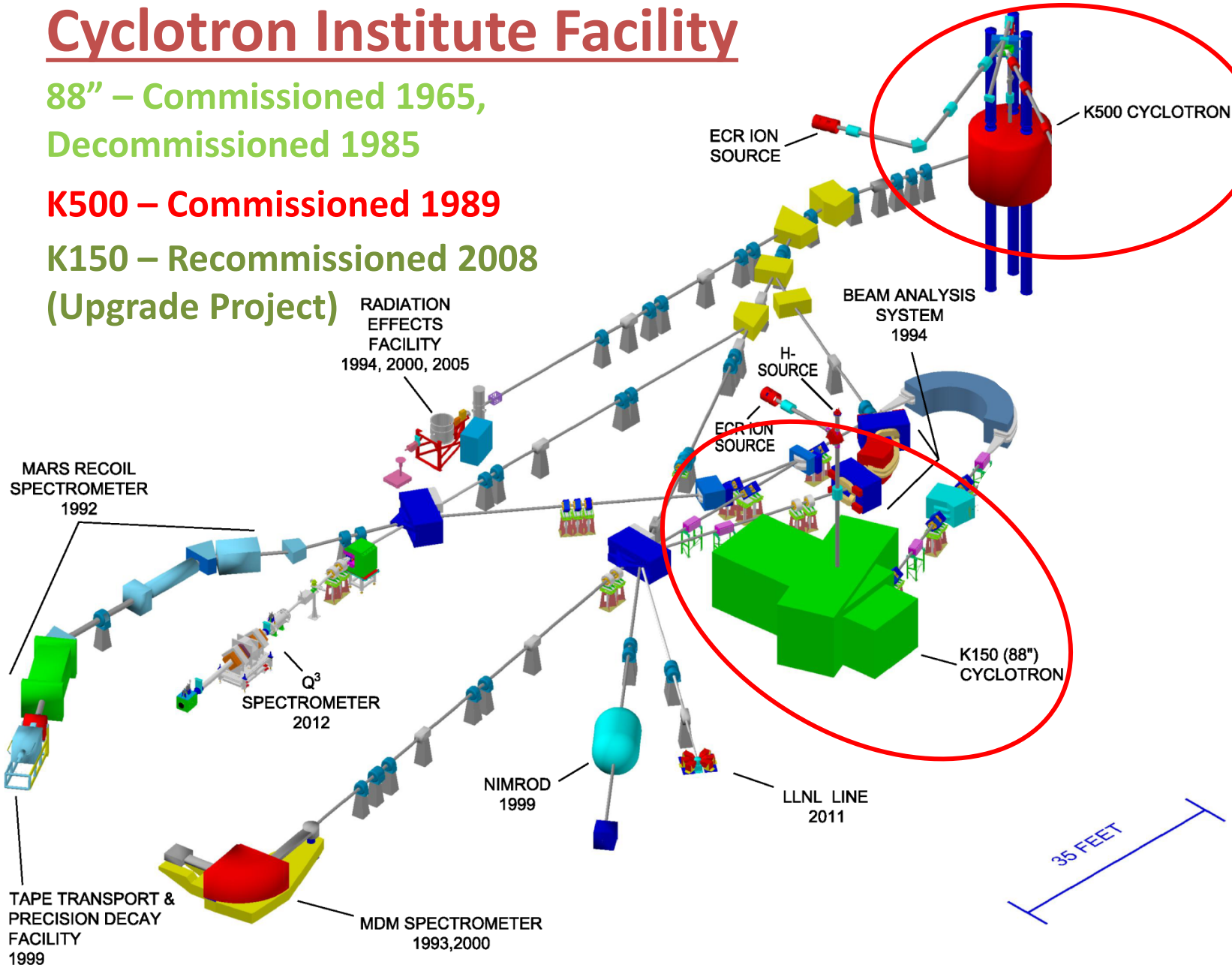
Cyclotron Institute Facility

88" – Commissioned 1965, Decommissioned 1985

K500 – Commissioned 1989

K150 – Recommissioned 2008 (Upgrade Project)

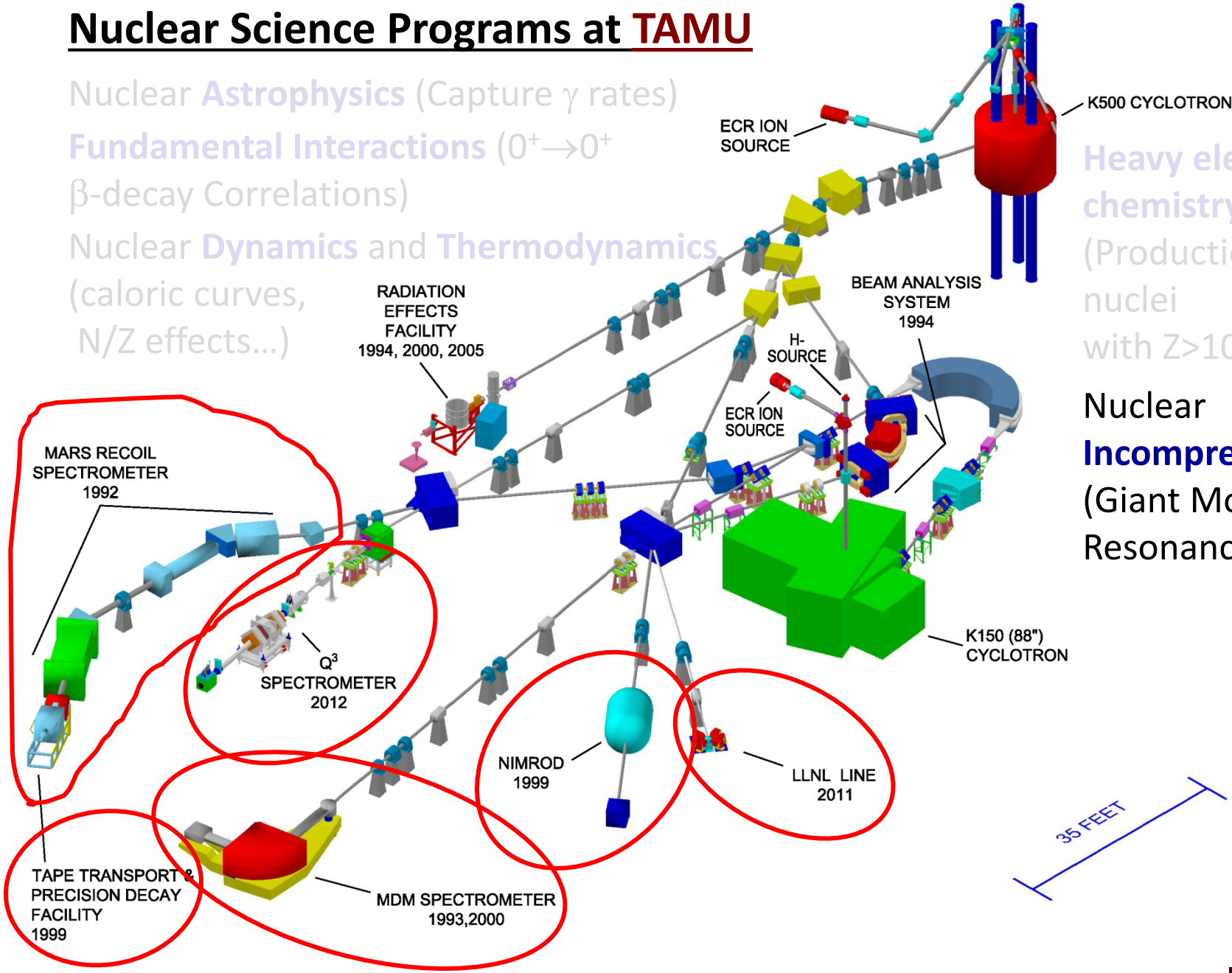


Nuclear Science Programs at TAMU

Nuclear **Astrophysics** (Capture γ rates)

Fundamental Interactions ($0^+ \rightarrow 0^+$ β-decay Correlations)

Nuclear **Dynamics** and **Thermodynamics** (caloric curves, N/Z effects…)



Heavy element chemistry (Production of nuclei with Z>100. . .)

Nuclear **Incompressibility** (Giant Monopole Resonance)

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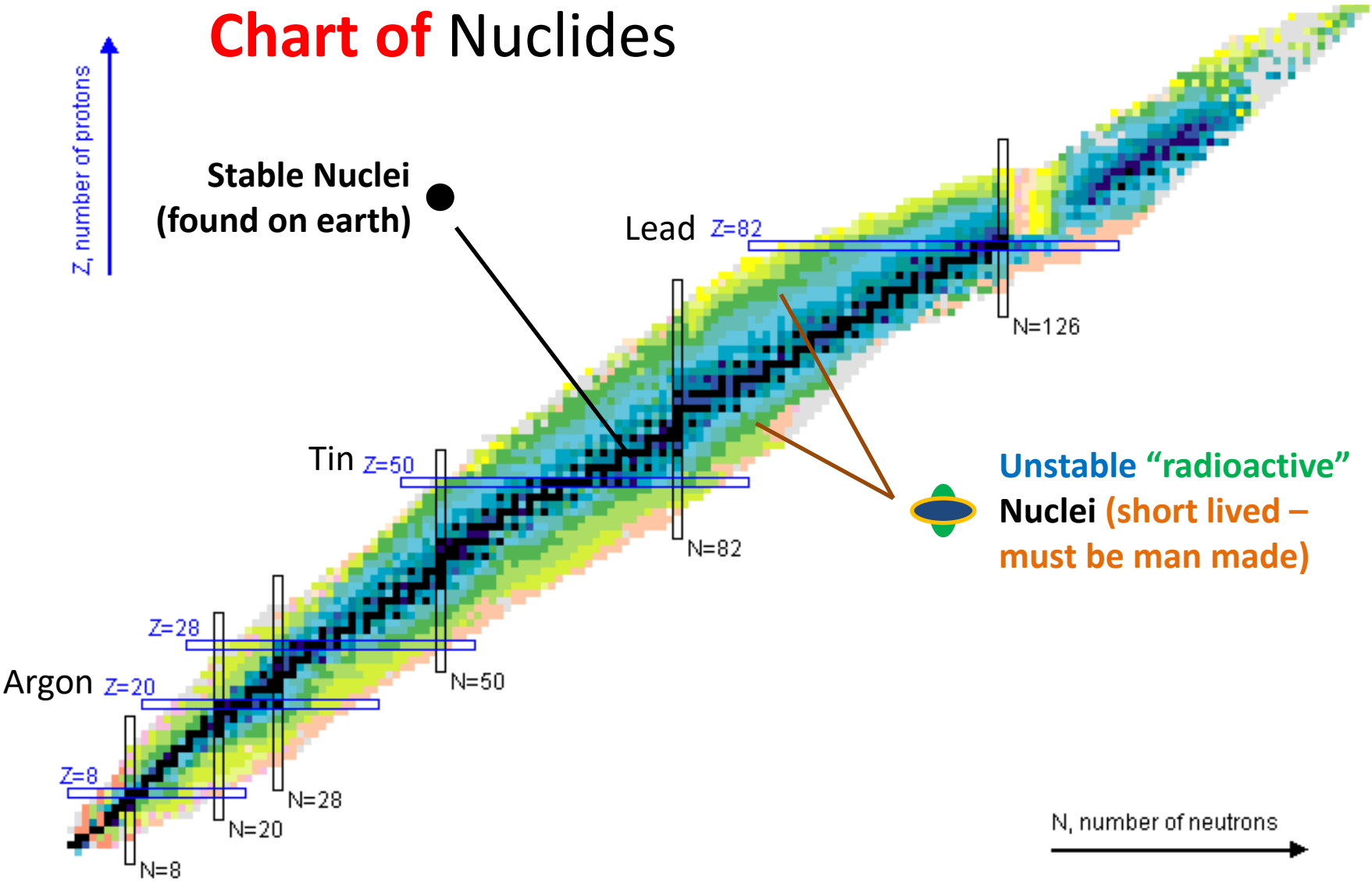
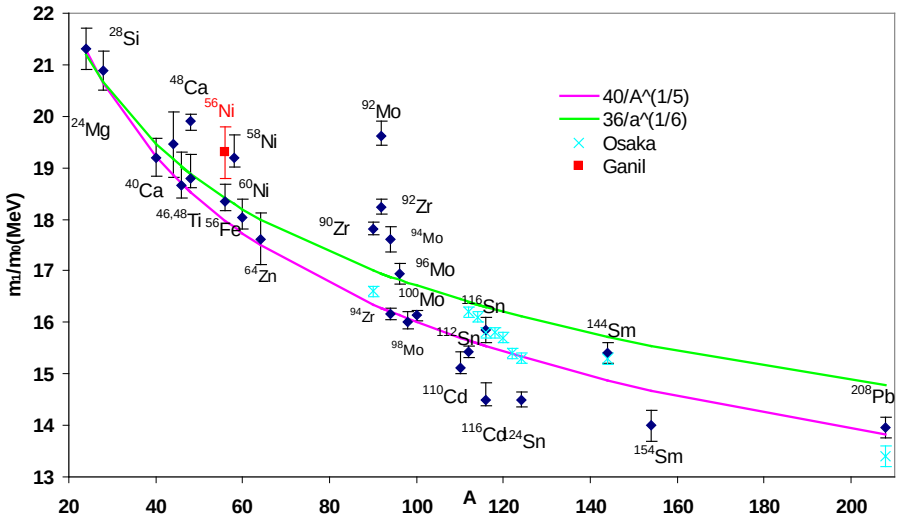
Chart of Nuclides



First Experiments with ^{27}Si RIBs:



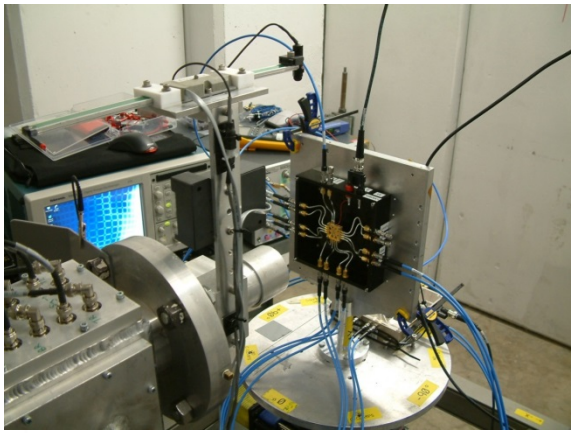
$E_{GMR}=(K_A/m\langle r^2\rangle)^{1/2}$, "Breathing mode" directly related to the Incompressibility of Nuclear Matter (important for EOS, density of neutron stars…)

Projected beam intensities from the Light Ion Guide after K500

(p,n)	Max Energy	Intensity
Product ($T_{1/2}$)	MeV/A	particles/s
^{27}Si (4.16s)	57	4×10^{4}
^{50}Mn (0.28s)	45	1×10^{5}
^{54}Co (0.19s)	45	4×10^{4}
^{64}Ga (2.63m)	45	2×10^{5}
^{92}Tc (4.25m)	35	2×10^{5}
^{106}In (6.20m)	28	4×10^{5}
^{108}In (58.0m)	28	2×10^{5}
^{110}In (4.9h)	26	4×10^{5}

Assuming 14 μA beam, realistic LIG, CBECR, transport and K500 extraction efficiencies

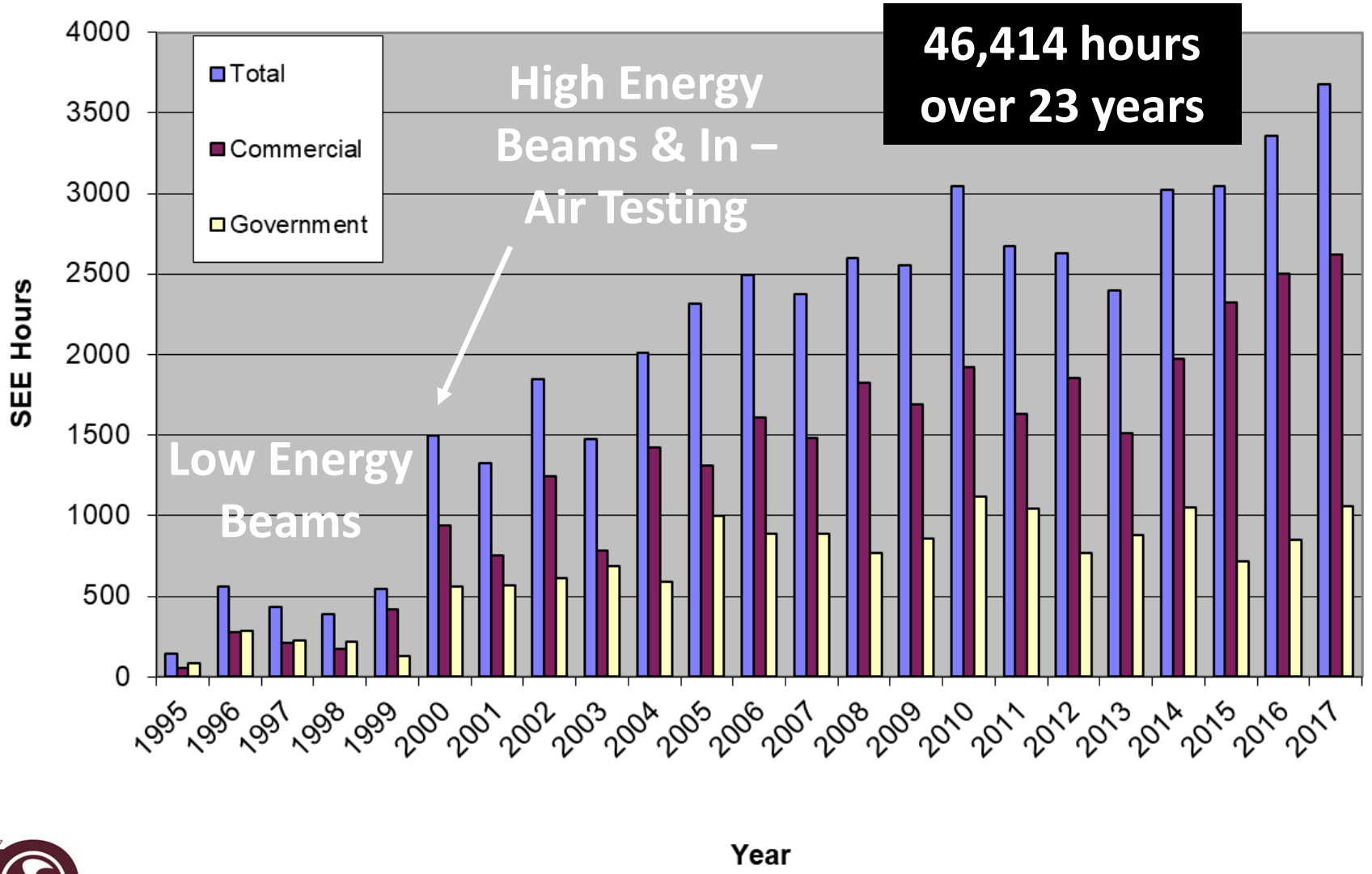
Two REF Beam Lines at Texas A&M



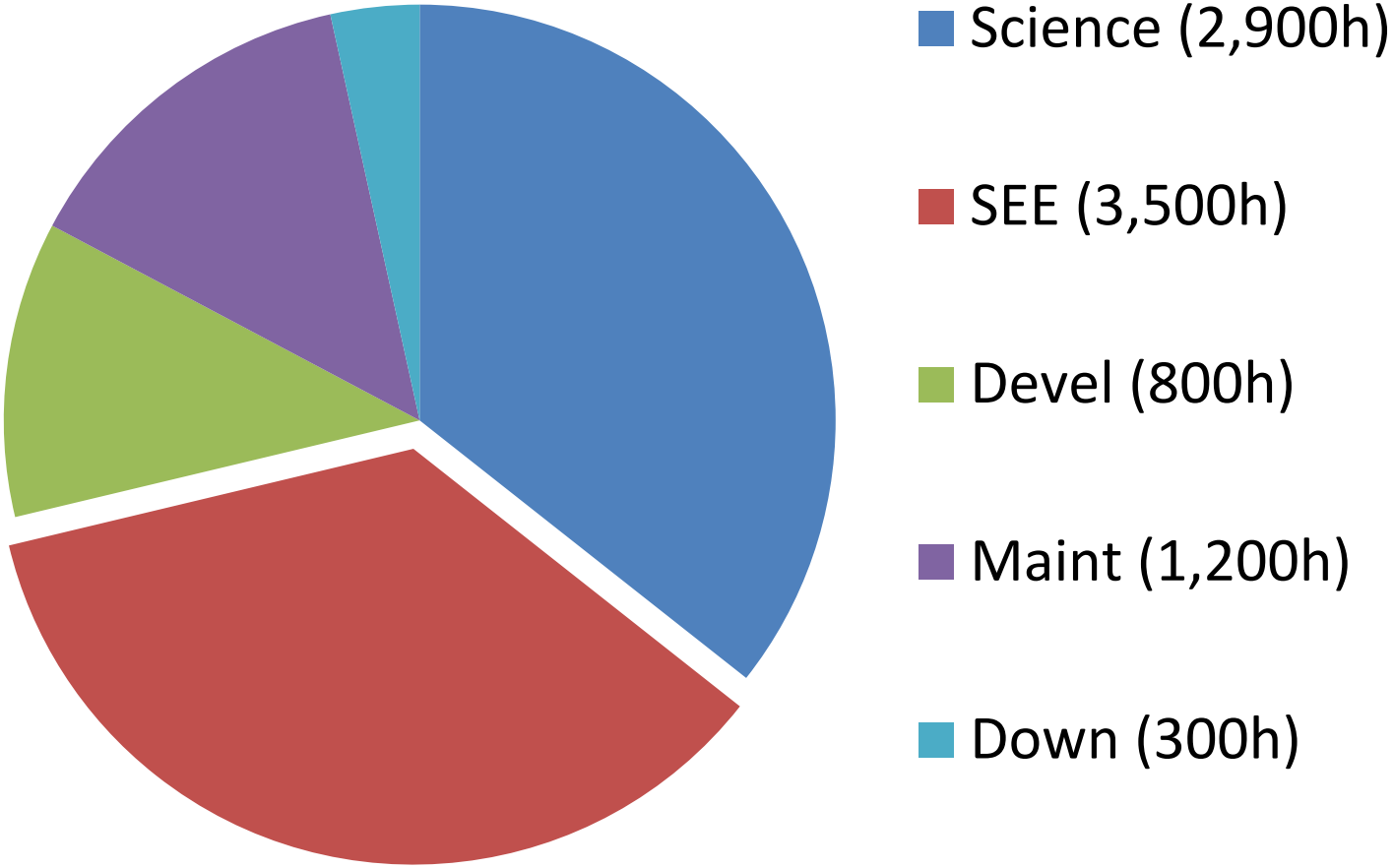
Heavy ions – K500 Cyclotron

Protons – K150 Cyclotron

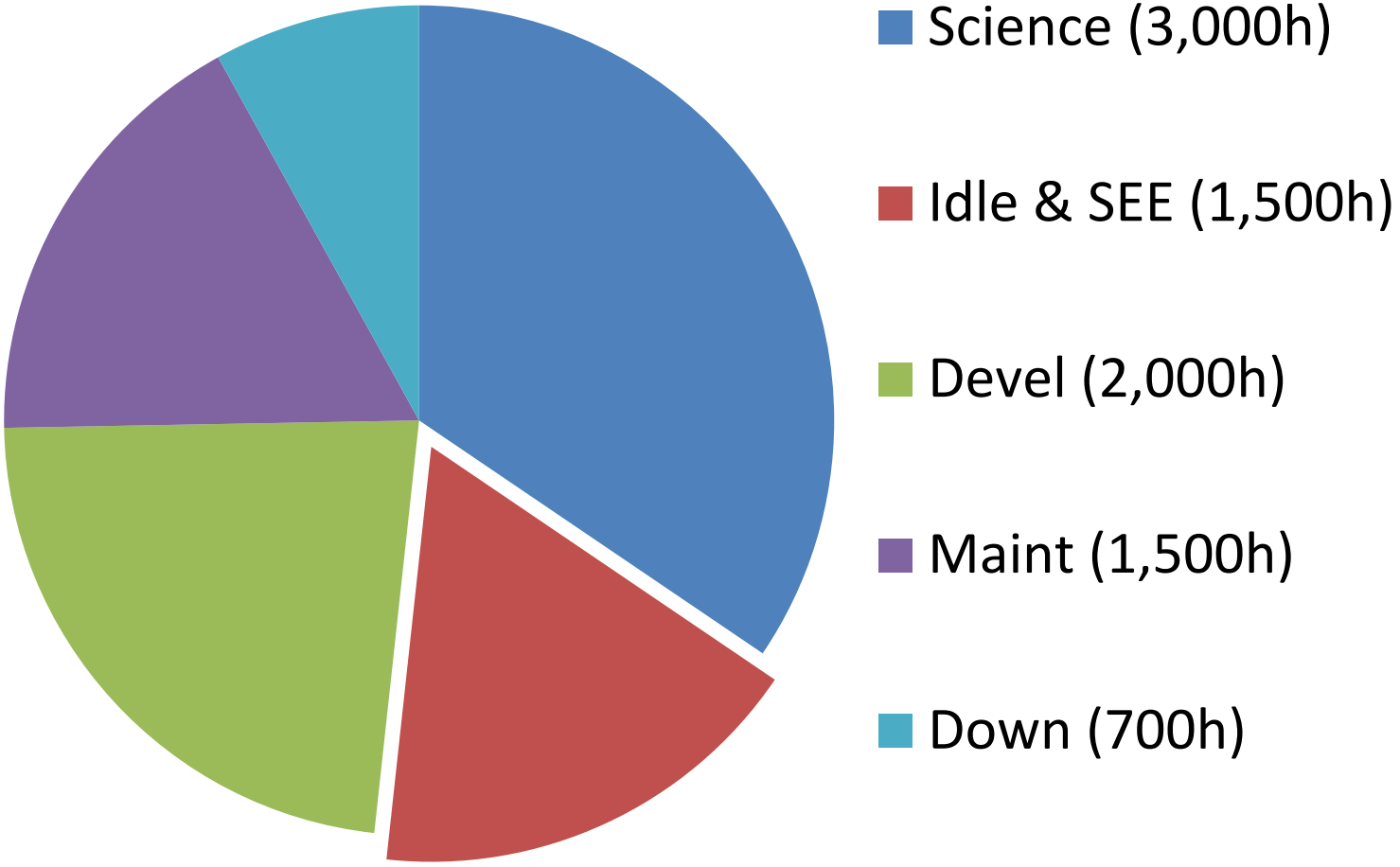
K500 REF Hours at Texas A&M



K500 Operating Hours (~8,700h/yr)



K150 Operating Hours (~8,700h/yr)

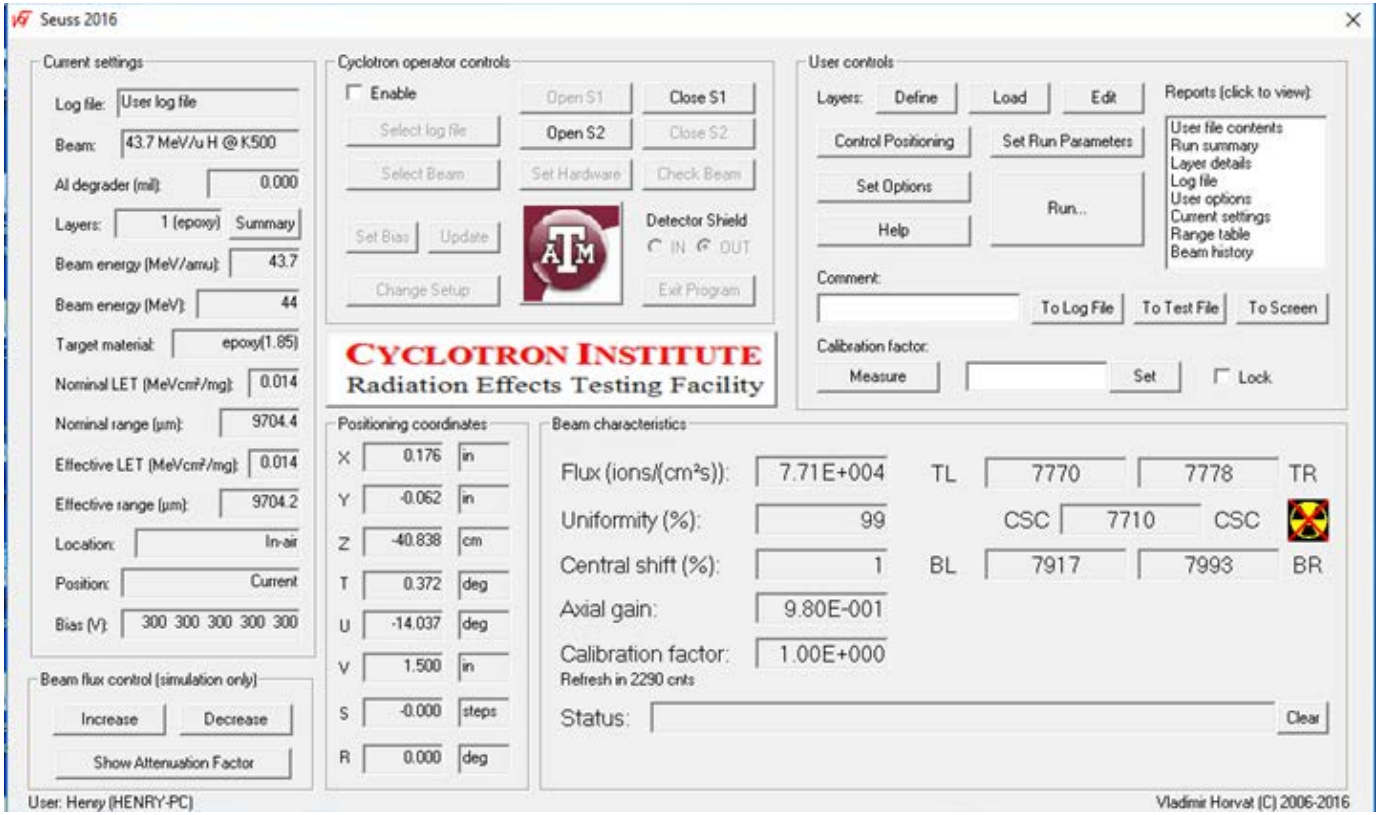


K150 Cyclotron REF Information:

- 1…45 MeV protons (tunable/mono-energetic)
- Energy (RF system) changes ~30 minutes
- Energy degrader wheel for fast energy changes
- Flux adjustable between 1E1 – 1E10 p/s-cm^2
- Uniform beam spots – 1” and 1.75” dia. (can be reduced to ¼” dia. with collimators)
- In-air testing station – 10” x 10” frame remotely controlled (x, y, z, θ, roll angle)
- Cable length ~60’ minimum
- ~300 testing hours in 2016, 2017

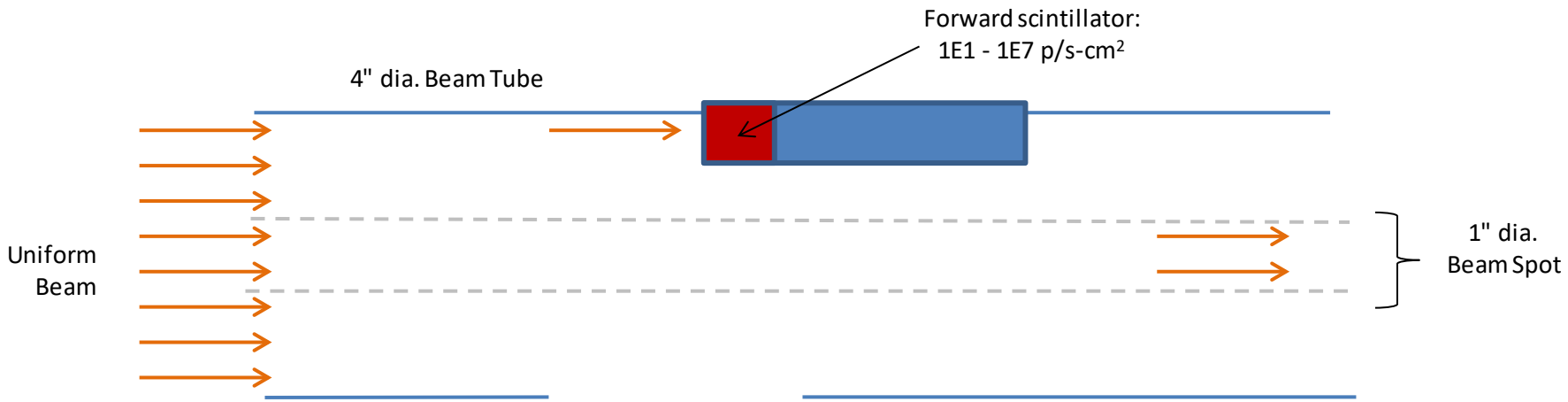
K150 REF - Dosimetry System

- We provide diagnostic equipment for complete dosimetry analysis and beam quality assurance.
- Test control and monitoring is conducted with the same custom SEUSS software on both beam lines.



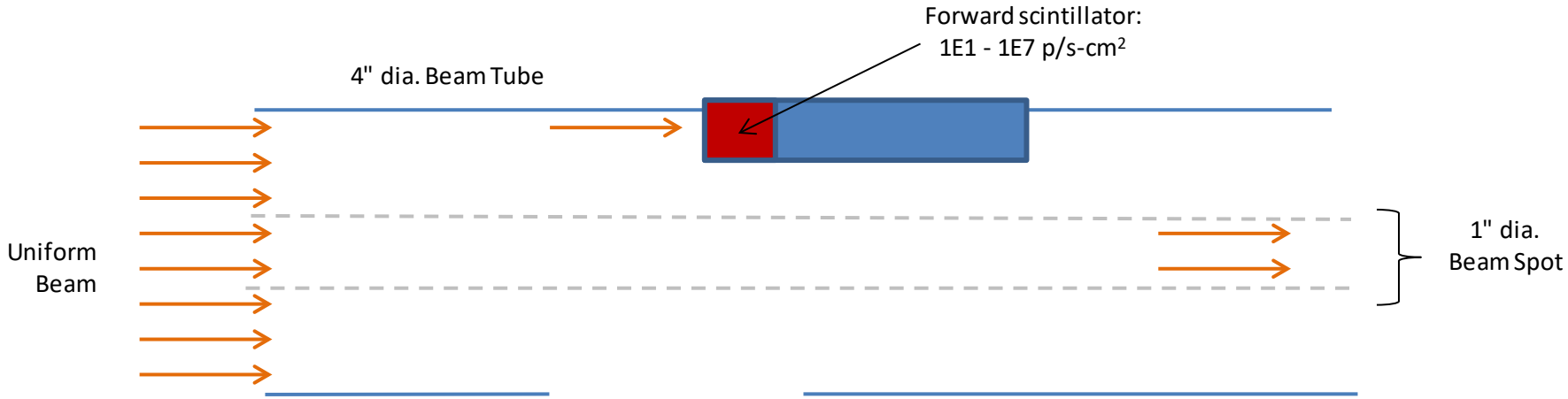
K150 REF - Dosimetry System

- Dosimetry at low flux (1E7 p/sec-cm^2 and lower) is conducted using an array of five detectors comprised of plastic scintillators coupled to photomultiplier tubes.



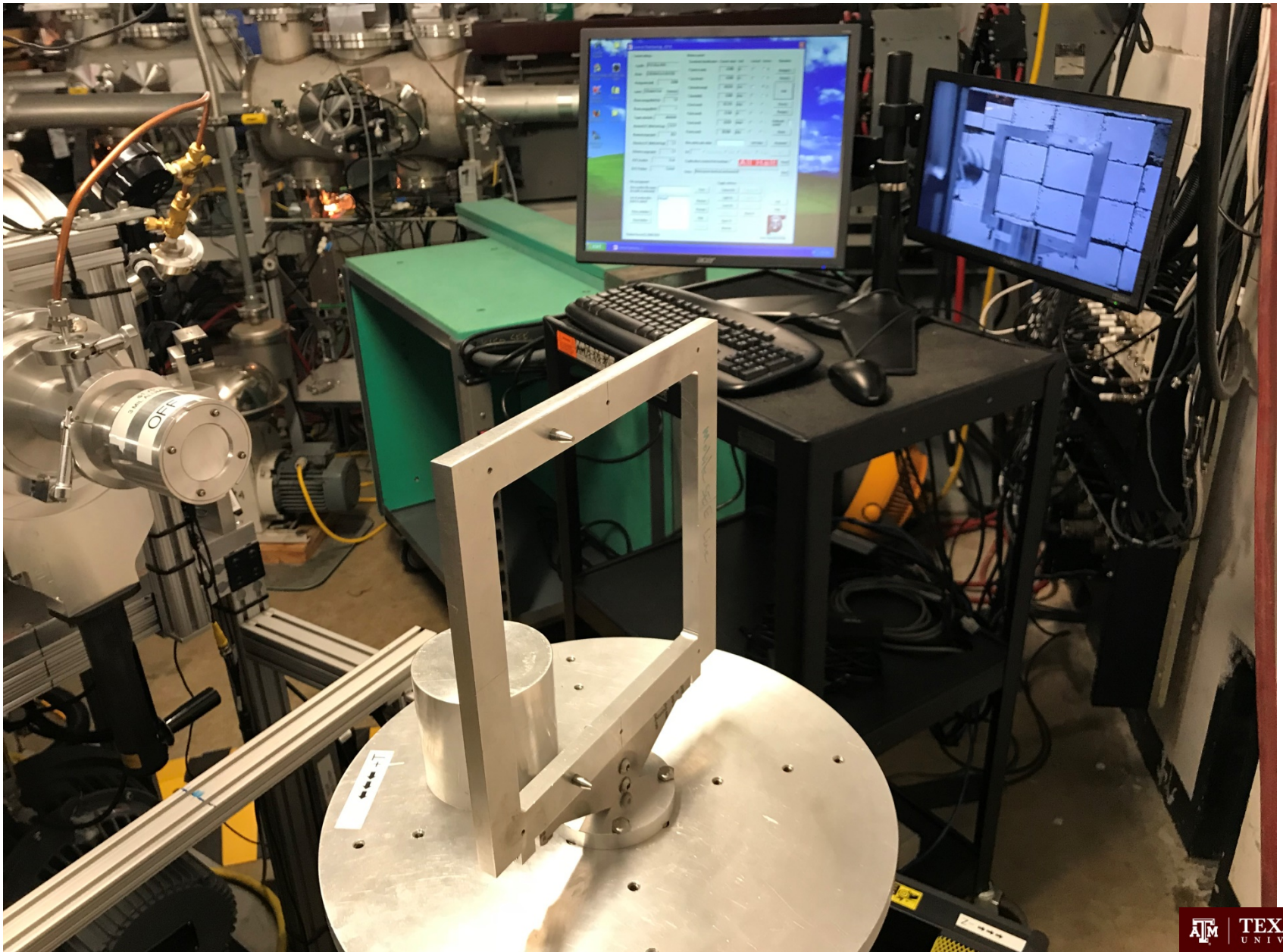
K150 REF - Dosimetry System

- For higher fluxes, uniformity is first adjusted at a lower flux and then a series of four Ta foils are used to backscatter protons into four additional detectors.
- After a calibration measurement, dosimetry is conducted using these back-scattered measurements.



K150 REF Beam Line

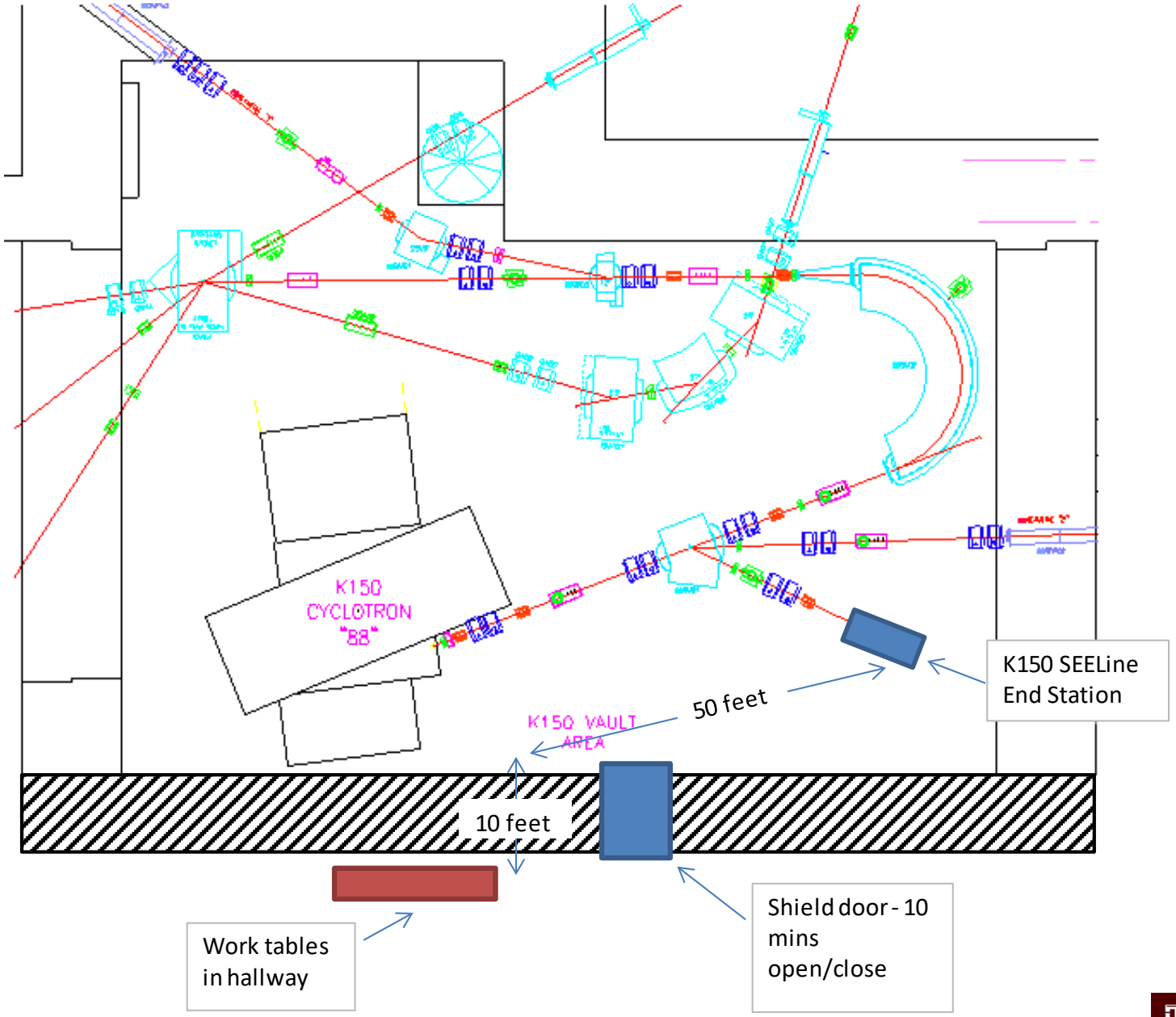
K150 REF End Station



K150 REF Neutron Shielded Equipment Carts

- 3” thick borated polyethylene.
- 4 carts available.

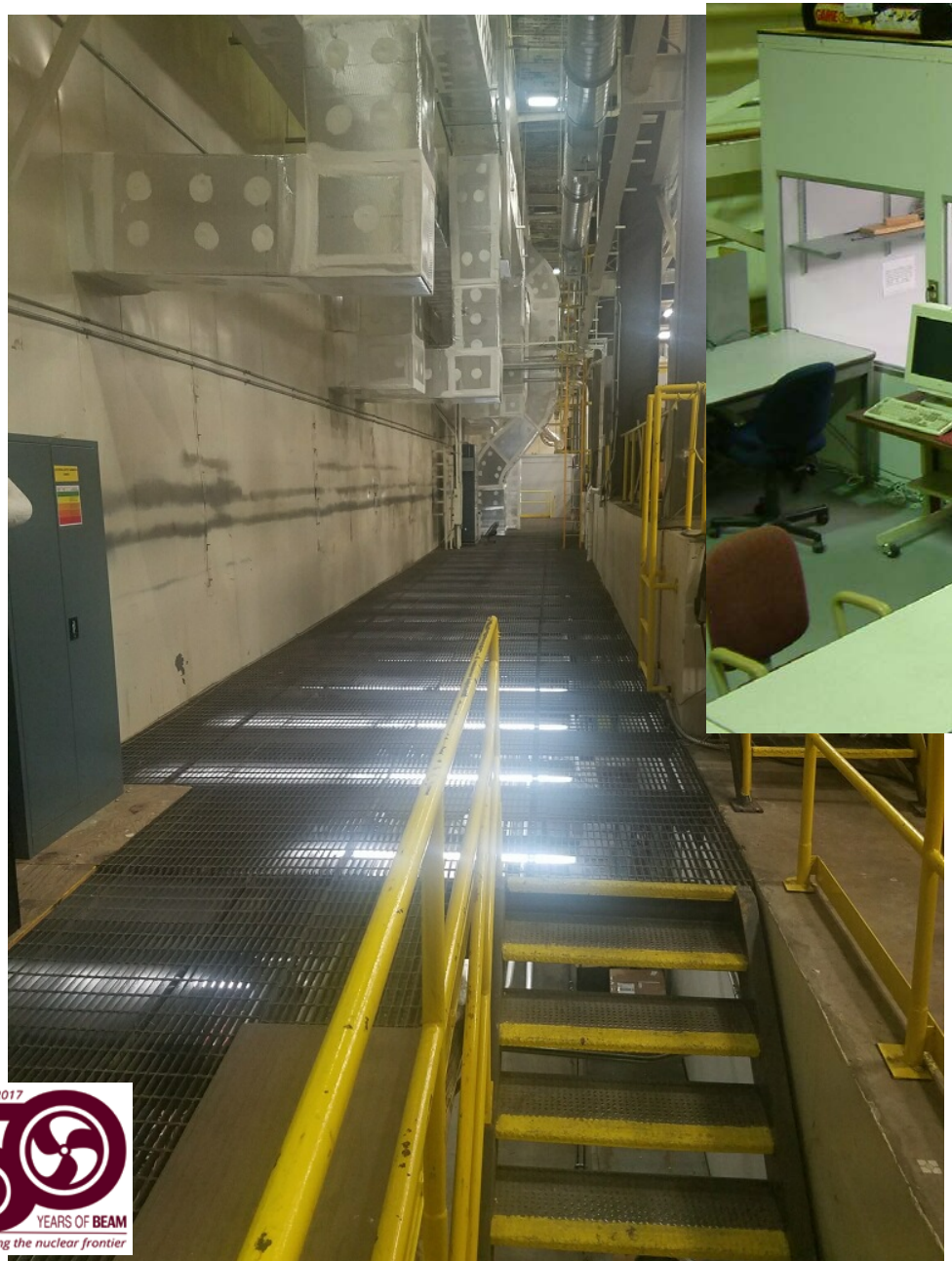
K150 REF – Building Layout



"New" K150 REF Neutron Shield Door

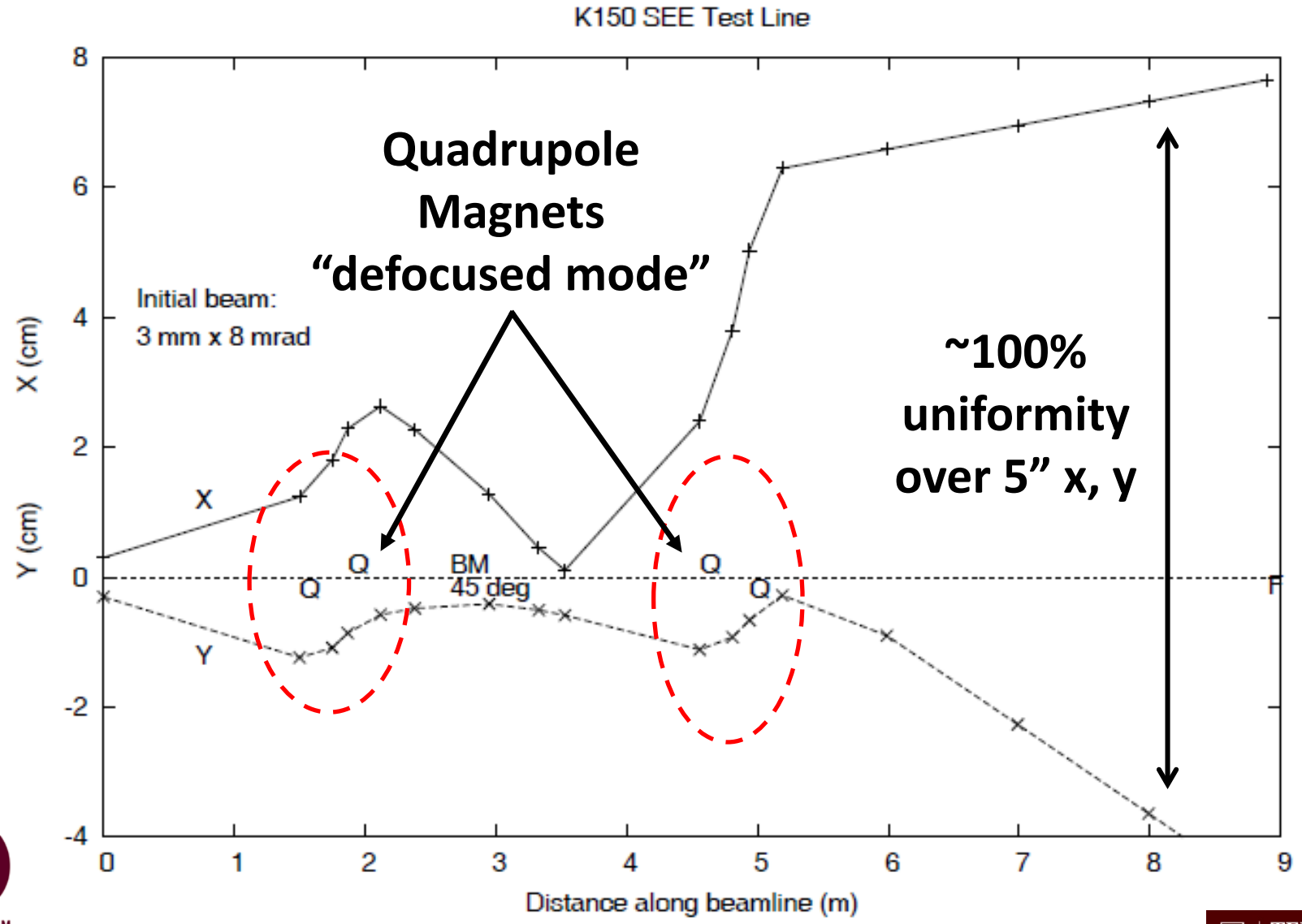
- 60 second Open/Close time.
- 6" thick borated polyethylene.
- Operational by the end of May 2018.

"New" K150 REF Data Room and Setup Area



- Same as K500 REF area.
- Doorway to be added for service elevator use.
- Cableway thru wall.
- Ready spring 2019.

"New" 5 inch Diameter Beam Spot



K150 REF Heavy Ion Beams "soon"

- ECR produces a wide range of heavy ions (p – Au).
- Extracted 15A MeV Cu & lighter.
- Cyclotron vacuum & injection system improvements needed.
- Driven by science.
- Ready 2020?

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Visit our website at

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